

Attachment 8. Quality Assurance

This section discusses the quality assurance and quality control (QA/QC) measures that will be used in completing the proposed GSFLOW numerical flow model project for the Solano Area. The majority of QA/QC will be performed for Tasks 1 (model development and calibration) and 7 (documentation and reporting), and to a lesser degree for the other 5 tasks (Tasks 2 through 6). All modeling efforts will follow methods outlined in the ASTM standards for data collection and checking, model development, calibration (and sensitivity analysis), and documentation. Many of these methods are incorporated in the discussion below in terms of model software selected, input data, model calibration, and reporting.

Model Software

The model software, GSFLOW, was chosen for several reasons, as described in the Work Plan (Attachment 5), but for QA/QC purposes, chosen because it is a tested and well established modeling platform written by the U.S. Geological Survey and utilized by many government and private professionals in the water resources industry.

Input Data

The data collected for use in the GSFLOW model includes time series climatic data, time series water level data, surface water deliveries, groundwater extraction rates, and many GIS coverage datasets (including land use, soil, geology, elevation, etc.). The quality of each of the input elements is expected to be high, as most data is made available from government agencies who have already performed their own internal and thorough QA/QC checks prior to making the data publicly available. Exceptions to that will be surface water deliveries and groundwater pumpage data, which will be examined prior to use in the model input files such that any outlier data entries will be verified or removed. As a general protocol for all input data, some internal checks and formatting will be performed to assure that the input data is of high quality and can therefore be relied upon. This will include, but is not limited to, plotting time series data to investigate and/or extract inappropriate outliers that may be artifacts of erroneous entries in the record, ensuring that the input data is consistent with the conceptual framework of the model, checking that all measurement units are consistent with the model input files' needs, identifying any deficiencies and potential sources of error due to uncertainty within the input data, etc.

Calibration of the Model

The calibration of the GSFLOW model provides an essential component of the QA/QC of this project. Modeled or simulated groundwater levels will be compared to measured or observed groundwater levels at as many locations as deemed sufficient to assure high quality results. This process of comparison and calibration of the GSFLOW model to actual data will ultimately enhance the accuracy of modeling results. Measured water level data will preferably be used for

wells that are completed in a unique aquifer unit (although water levels from composite or unknown well completions may also be used for calibration in areas lacking aquifer-specific data). Residuals between measured values and simulated values will be calculated to assist in the calibration. A sensitivity analysis will be performed to identify and help isolate variables in the model that have the most effect on model results. Model input parameters will be adjusted based on results of the calibration and sensitivity processes to better simulate reality (reduce the residuals) and create a robust and stable model that is consistent with the conceptual model of the Solano County area. A comprehensive calibration will ensure that the GSFLOW model can be used as a tool for a wide variety of different simulations with varying groundwater management purposes (i.e. conjunctive use, pumpage distributions, operations during periods of lowered groundwater levels, etc.).

Caliber of the Professionals Working on the Project

The project will be mostly completed by the staff of Luhdorff & Scalmanini, Consulting Engineers (LSCE), based out of Woodland, CA. This firm has a reputation for completing impeccable work in the groundwater resources field. Their specialties include groundwater resource evaluation; water resources development and management; groundwater modeling; soil and/or groundwater monitoring and contamination evaluation; water well design; and aquifer testing. The individuals assigned to this project have professional certification (Professional Geologists, Professional Hydrogeologists, etc.) in the State of California or will be under the direct supervision of professionally certified staff members.

Review Processes for Simulations and Reporting

Each of the tasks following the model development and calibration (Tasks 2 through 7) will require some internal and external review by SCWA and the consultants, LSCE. The results from the conjunctive use and pumpage distribution simulations (Tasks 2 and 3) will be carefully scrutinized to be sure that results of the model make sense in the context of what is known about the behavior of the groundwater and surface water resources in the Solano area. Model results from Tasks 4 through 6 will also be inspected to assure that the recharge analysis, interconnectivity between aquifer units, implications of declines in water levels and subsidence, and water budget components are all accurate and reasonable within the context of the understanding of subsurface behaviors in the Solano area.

The quarterly progress reports will provide an opportunity to evaluate the progress and work products being achieved at regular intervals for the duration of the project. In addition, the draft model documentation report will be shared with the SCWA member entities, which will provide for the opportunity of peer review and a thorough critical review before the final document is published.